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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/457,929	12/08/1999	JACK CHIHCHIEH YAO	A-64873-1/AJ	8226

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EXAMINER	
LUND, JEFFRIE ROBERT	
ART UNIT	PAPER NUMBER
1763	22

DATE MAILED: 06/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Applicati n No.	Applicant(s)	
	09/457,929	YAO ET AL.	
	Examin r	Art Unit	
	Jeffrie R. Lund	1763	

-- Th MAILING DATE of this communication app ars on th cover sheet with th correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 May 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,6,8,10 and 11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,6,8,10 and 11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 October 1999* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-4, 6, 8, 10, and 11 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The newly added limitation "to maintain continuous contact" is not supported by the specification. The specification supports the idea of "a point or line contact" (page 6 line 10) or "approaches line contact" (page 6 line 30). Nowhere in the specification does it specify that the wafer edge is in "continuous" contact. Furthermore, the applicant does not explain how this is achieved since the typical contact between two highly polished surfaces is typically less than 50% due to atomic level differences.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 3, 4, 6, 8, 10, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over McDiarmid US patent 5,242,501, in view of Grabmaier et al, US Patent 3,151,006.

McDiarmid teaches a circular plate susceptor (wafer carrier) 216, 316 that has a flat edge extending around the circumference of the plate, and a circular recess center region 220, 320 having a recessed bottom surface 222, 322 and including an upwardly inclined surface 221, 321 around the periphery of the recess bottom. The substrate is supported by a portion of the upwardly inclined surface and is spaced apart from the recessed bottom surface, such that, the substrate is continuously supported by the wafer carrier only around the periphery edge of the substrate (see column 4 lines 65-67). McDiarmid also teaches that the dimensions of the susceptor can be optimized to fit a variety of size substrates, and the space between the substrate and susceptor can be optimized to control the heat flow from the susceptor to the substrate. (Entire document)

McDiarmid does not teach that the wafer carrier is made out of silicon carbide, large-grained polycrystalline silicon or silicon/silicon carbide alloy, the edge region has a width of 5 to 25 mm, the upwardly inclined surface is inclined at an angle of 5° to 45°, specifically, 10°, the recess is 200 mm or 300 mm (to fit a 200 or 300 mm substrate), or that the space between the back of the substrate is between 0.15 mm to 0.5 mm, specifically, 0.25 mm.

Grabmaier et al teaches a carrier rod (wafer carrier) made of a highly pure silicon rod.

Silicon carbide, large-grained polycrystalline silicon and silicon/silicon carbide alloy are all well known materials of construction used in semiconductor processing apparatus, and all have been used for many years. Furthermore, graphite is known to introduce contaminants into the chamber i.e. carbon and is very vulnerable to chemical attack i.e. etching or oxidation.

The motivation for making the susceptor of McDiarmid out of silicon carbide, large-grained polycrystalline silicon or silicon/silicon carbide alloy, as taught by Grabmaier et al or as is known in the art, is to provide an alternate and equivalent material of construction; or an alternate and superior material of construction that is more stable and chemically inert to the reaction gases.

The motivation for sizing the recess to a specific size is to hold a specific size substrate, the motivation for optimizing slope of the incline and therefore the size of the space between the substrate and the susceptor is to optimize the heat flow between the susceptor and the substrate, both of which are taught by McDiarmid. The motivation for optimizing the size of the flat region is to optimize the heating of the outer edge of the wafer and optimizing the gas flow across the substrate. Furthermore, it was held in *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), by the Federal Circuit that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. (Also see MPEP 2144.04 (d))

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention was made to: make the susceptor of McDiarmid out of silicon carbide, large-grained polycrystalline silicon or silicon/silicon carbide alloy as taught by Grabmaier et al or as is known in the art; size the recess to 200 or 300 mm; make the upwardly inclined surface an angle of 5° to 45°, specifically, 10°, to size the space between the susceptor to 0.15 to 0.5 mm, specifically, 0.25 mm; and to size width of the flat area of the susceptor to 5 to 25 mm.

3. Claims 1, 3, 4, 6, 8, 10, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Inoue et al, 5,677,253, in view of McDiarmid US patent 5,242,501.

Inoue et al teaches a circular wafer holding member 1 made of aluminum nitride (entire document).

Inoue et al does not teach a circular plate susceptor (wafer carrier) that has: a flat edge extending around the circumference of the plate; a circular recess center region having a recessed bottom surface, which includes an upwardly inclined surface around the periphery of the recess bottom that supports a wafer, spaced apart from the recessed bottom surface, such that, the substrate is continuously supported by the wafer carrier only around the periphery edge of the substrate; the edge region has a width of 5 to 25 mm, the upwardly inclined surface is inclined at an angle of 5° to 45°, specifically, 10°, the recess is 200 mm or 300 mm (to fit a 200 or 300 mm substrate), or that the space between the back of the substrate is between 0.15 mm to 0.5 mm, specifically, 0.25 mm.

McDiarmid teaches a circular plate susceptor (wafer carrier) 216, 316 that has a flat edge extending around the circumference of the plate, and a circular recess center region 220, 320 having a recessed bottom surface 222, 322 and including an upwardly inclined surface 221, 321 around the periphery of the recess bottom. The substrate is supported by a portion of the upwardly inclined surface and is spaced apart from the recessed bottom surface, such that, the substrate is continuously supported by the wafer carrier only around the periphery edge of the substrate (see column 4 lines 65-67). McDiarmid also teaches that the dimensions of the susceptor can be optimized to fit a variety of size substrates, and the space between the substrate and susceptor can be optimized to control the heat flow from the susceptor to the substrate. (Entire document)

The motivation for adding a flat edge extending around the circumference of the plate; a circular recess center region having a recessed bottom surface, which includes an upwardly inclined surface around the periphery of the recess bottom that supports a wafer, spaced apart from the recessed bottom surface, such that, the substrate is continuously supported by the wafer carrier only around the periphery edge of the substrate to the holding member of Inoue et al as taught by McDiarmid is to prevent the substrate from being warped and to reduce slip caused by the thermal gradients created by placing a substrate on a flat surface of wafer carrier.

The motivation for sizing the recess to a specific size is to hold a specific size substrate, the motivation for optimizing slope of the incline and therefore the size of the space between the substrate and the susceptor is to optimize the heat flow between the

susceptor and the substrate, both of which are taught by McDiarmid. The motivation for optimizing the size of the flat region is to optimize the heating of the outer edge of the wafer and optimizing the gas flow across the substrate. Furthermore, it was held in *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), by the Federal Circuit that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. (Also see MPEP 2144.04 (d))

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention was made to: add a flat edge extending around the circumference of the plate; a circular recess center region having a recessed bottom surface, which includes an upwardly inclined surface around the periphery of the recess bottom that supports a wafer, spaced apart from the recessed bottom surface such that the wafer is supported by the wafer carrier only around the periphery edge of the substrate to the wafer holding member of Inoue et al as taught by McDiarmid; size the recess to 200 or 300 mm; make the upwardly inclined surface an angle of 5° to 45°, specifically, 10°, to size the space between the susceptor to 0.15 to 0.5 mm, specifically, 0.25 mm; and to size width of the flat area of the susceptor to 5 to 25 mm.

4. Claims 1-4, 6, 8, 10, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over MacLeish et al, US Patent 5,891,251, in view of Grabmaier et al, US Patent 3,151,006.

MacLeish et al teaches a circular plate susceptor (wafer carrier) 50 that has a flat edge extending around the circumference of the plate; a circular recess center region having a recessed bottom surface 51c and including an upwardly inclined surface 51b around the periphery of the recess bottom; and a support member (lift pin) 54 to engage the substrate. The substrate is supported by a portion of the upwardly inclined surface and is spaced apart from the recessed bottom surface (about 0.08-0.13 mm), such that, the substrate is continuously supported by the wafer carrier only around the periphery edge of the substrate. (Entire document) MacLeish et al does not disclose any dimensions in the drawings, specification, or claims.

MacLeish et al does not teach that: the wafer carrier is made out of silicon carbide, large-grained polycrystalline silicon or silicon/silicon carbide alloy, the recess is 200 mm or 300 mm (to fit a 200 or 300 mm substrate), the space between the back of the substrate is between 0.15 mm to 0.5 mm, specifically, 0.25 mm, the upwardly inclined surface is inclined at an angle of 5° to 45°, specifically, 10°, or that the flat edge region of the susceptor is 5 to 25 mm wide.

Grabmaier et al teaches a carrier rod (wafer carrier) made of a highly pure silicon rod.

Silicon carbide, large-grained polycrystalline silicon and silicon/silicon carbide alloy are all well known materials of construction used in semiconductor processing apparatus, and all have been used for many years. Furthermore, graphite is known to introduce contaminants into the chamber i.e. carbon and is very vulnerable to chemical attack i.e. etching or oxidation.

The motivation for making the susceptor of MacLeish out of silicon carbide, large-grained polycrystalline silicon or silicon/silicon carbide alloy, as taught by Inoue et al or Grabmaier et al or as is known in the art, is to provide an alternate and equivalent material of construction; or an alternate and superior material of construction that is more stable and chemically inert to the reaction gases.

One of ordinary skill in the art at the time the invention was made after reading the specification of MacLeish et al would be motivated to build the apparatus of MacLeish et al and find the optimum dimensions for each of the parts of the apparatus to ensure that the apparatus would function as taught by MacLeish et al. Furthermore, it was held in *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), by the Federal Circuit that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. (Also see MPEP 2144.04 (d))

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention was made to: make the susceptor of MacLeish out of silicon carbide, large-grained polycrystalline silicon or silicon/silicon carbide alloy as taught by Grabmaier et al or as is known in the art; size the recess to 200 or 300 mm; size the space between the susceptor to 0.15 to 0.5 mm, specifically, 0.25 mm; and to size the flat edge region of the susceptor to 5 to 25 mm.

5. Claims 1-4, 6, 8, 10, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Inoue et al, 5,677,253, in view of MacLeish et al, US Patent 5,891,251.

Inoue et al teaches a circular wafer holding member 1 made of aluminum nitride (entire document).

Inoue et al does not teach a circular plate susceptor (wafer carrier) that has: a flat edge extending around the circumference of the plate; a circular recess center region having a recessed bottom surface, which includes an upwardly inclined surface around the periphery of the recess bottom that supports a wafer, spaced apart from the recessed bottom surface, such that, the substrate is continuously supported by the wafer carrier only around the periphery edge of the substrate; a support member to engage the substrate; the edge region has a width of 5 to 25 mm, the upwardly inclined surface is inclined at an angle of 5° to 45°, specifically, 10°, the recess is 200 mm or 300 mm (to fit a 200 or 300 mm substrate), or that the space between the back of the substrate is between 0.15 mm to 0.5 mm, specifically, 0.25 mm.

MacLeish et al teaches a circular plate susceptor (wafer carrier) 50 that has a flat edge extending around the circumference of the plate; a circular recess center region having a recessed bottom surface 51c and including an upwardly inclined surface 51b around the periphery of the recess bottom; and a support member (lift pin) 54 to engage the substrate. The substrate is supported by a portion of the upwardly inclined surface and is spaced apart from the recessed bottom surface (about 0.08-0.13

mm), such that, the substrate is continuously supported by the wafer carrier only around the periphery edge of the substrate. (Entire document)

The motivation for adding a flat edge extending around the circumference of the plate; a circular recess center region having a recessed bottom surface, which includes an upwardly inclined surface around the periphery of the recess bottom that supports a wafer, spaced apart from the recessed bottom surface, such that, the substrate is continuously supported by the wafer carrier only around the periphery edge of the substrate to the holding member of Inoue et al as taught by MacLeish et al is to provide an alternate and equivalent susceptor design as taught by MacLeish et al.

The motivation for sizing the recess to a specific size is to hold a specific size substrate, the motivation for optimizing slope of the incline and therefore the size of the space between the substrate and the susceptor is to optimize the heat flow between the susceptor and the substrate. The motivation for optimizing the size of the flat region is to optimize the heating of the outer edge of the wafer and optimizing the gas flow across the substrate. Furthermore, it was held in *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), by the Federal Circuit that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. (Also see MPEP 2144.04 (d))

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention was made to: add a flat edge extending around the circumference of the plate; a circular recess center region having a recessed bottom surface, which includes an upwardly inclined surface around the periphery of the recess bottom that supports a wafer, spaced apart from the recessed bottom surface such that the wafer is supported by the wafer carrier only around the periphery edge of the substrate to the wafer holding member of Inoue et al as taught by MacLeish et al; size the recess to 200 or 300 mm; make the upwardly inclined surface an angle of 5° to 45°, specifically, 10°, to size the space between the susceptor to 0.15 to 0.5 mm, specifically, 0.25 mm; and to size width of the flat area of the susceptor to 5 to 25 mm.

Response to Arguments

6. Applicant's arguments filed May 8, 2003 have been fully considered but they are not persuasive.

In regard to the argument that neither McDiarmid nor MacLeish et al teach or suggest a wafer carrier that maintains a line contact continuously with only the periphery edge of the wafer, the examiner disagrees. The entire disclosure of McDiarmid is directed to supporting the substrate continuously with only the periphery edge of the wafer. MacLeish et al also discloses continuously supporting a substrate along its edge.

In regard to the argument that neither McDiarmid nor MacLeish et al even describe the problems of wafer backside damages and contaminations caused by the surface contact with the susceptor, and the backseal applications that are made

possible by the continuous line contact, the examiner agrees. However, these benefits are inherent in the type of holder claimed and are well known in art.

In regard to the argument that Grabmaier et al does not teach the desired shape of the wafer holder, the examiner agrees. The rejection is based on a combination of McDiarmid or MacLeish et al, which teach the shape, and Grabmaier et al, which teaches the material. One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

In regard to the argument that the selection of material is not simple, or obvious, and there is no motivation to select a specific material, the examiner disagrees. The selection of a material is a primary design criterion, and a basic part of any design process. One of ordinary skill in the art must determine the conditions to which the object i.e. holder will be exposed, and then select the proper material. If a cheap material i.e. graphite is not capable of functioning as required in a given environment then a more expensive material must be chosen. Graphite has been used for many years in the semiconductor processing apparatus art, and is well known for its susceptibility to chemical attack, which results in contamination of the processing environment. In fact, it is often coated with the claimed material to improve its chemical resistance and other physical properties as is shown in the art of record. As a result, graphite has been replaced in the art by other more chemically inert materials such as those claimed by the applicant. Silicon carbide, aluminum nitride, large-grained

polycrystalline silicon or silicon/silicon carbide alloy are all frequently used in the art as carriers because of their chemical resistance. Despite their higher initial cost, their longer life and less contamination of the product, results in a lower long-term cost. Therefore, the motivation for replacing a graphite susceptor with another material is to prevent contamination of the substrate or prolong the life of the susceptor by choosing a material that is more chemically inert.

In regard to the argument that one of ordinary skill has to be guided by the claims of present invention with respect to the thermal expansion and thermal conductivity of the materials, and the size and dimension of the carrier design in order to produce the wafer carrier of the invention that provides continuous line contact with only the periphery edge of the wafer during the processing without producing adverse effects such as wafer backside damages and contamination ad deposition on the wafer backside, the examiner disagrees. First, the claims only claim a specific thermal conductivity, and do not claim any specific thermal expansion. The specific thermal expansion and thermal conductivity taught in the specification and original claims include the claimed materials and graphite, as has been discussed in previous actions. Second, It was held in *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), by the Federal Circuit that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. (Also see MPEP 2144.04

(d)) The susceptors of McDiarmid and MacLeish et al having the claimed relative dimensions would not perform differently than the prior art device; the claimed device is not patentably distinct from the prior art device.

In regard to the argument that MacLeish et al teaches contact at "a minimum number of points" does not meet the limitation of "continuous", the examiner disagrees. The specification teaches that, "The point or line contact, minimizes contact with the wafer" (page 6 lines 10-11). Since the design of the wafer holder of the present invention has the same general cross-section as the susceptor taught by MacLeish et al and both described as minimizing the contact with the wafer, then the susceptor of MacLeish et al supports the wafer continuously as claimed by the applicant. The examiner notes that supporting a wafer on a surface that slopes upward as claimed and taught by McDiarmid and MacLeish et al inherently hold the substrate along a continuous line, it is the only way that they can hold a substrate of the same size and shape.

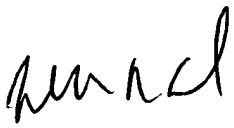
7. Applicant's arguments with respect to claims 1-4, 6, 8, 10, and 11 have been considered but are moot in view of the new ground(s) of rejection.

In regard to the argument directed to Inoue et al, the new rejections modify the structure of the wafer holder of Inoue et al as taught by McDiarmid and MacLeish et al. Therefore, the arguments presented are moot.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrie R. Lund whose telephone number is (703) 308-1796. The examiner can normally be reached on Monday-Thursday (6:30 am-6:00pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (703) 308-1633. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



Jeffrie R. Lund
Primary Examiner
Art Unit 1763

JRL
June 14, 2003